

# Chapter 4

## Streamside Management Zones and Riparian Buffers

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#### **For Forest Owners:**

*In most cases SMZs and riparian buffers need not be treated as 'no-cut' preserve areas. Forest harvesting can be used to regenerate trees in the SMZ or buffer. This fresh tree growth in turn helps protect water quality and maintain the biological and financial viability of working forests.*

### **Part 1 -- Function of SMZs and Riparian Buffers**

A streamside management zone (SMZ) or riparian buffer can help achieve multiple water quality goals, many of which are discussed in detail under Chapter 1, Part 4 -- Importance of BMPs. These goals usually focus on:

- Slowing and filtering runoff.
- Capturing sediment.
- Providing shade from sunlight intensity.
- Maintaining streambank stability.
- Ameliorating impacts from biological pollution agents such as nutrient input or fecal coliform, both of which can result from other land use practices.

#### **Water Quality Link**

Establishing a zone or buffer of reduced or minimal disturbance alongside the edges of a stream or waterbody has proven to be one of the most effective and least expensive methods to implement for protecting water quality.

In this manual, BMPs are recommended that protect water quality and conserve soil resources based upon site-specific factors that determine the degree of protection needed for a stream or other waterbody. The site factors that most often influence SMZ and riparian buffer use are noted below:

#### **Slope**

Steeper slopes may require wider buffers and/or additional measures to slow down and capture fast-moving runoff.

#### **Soils**

Some soils are more likely to erode than others. In these cases a wider buffer or other measures are needed to prevent erosion. A NRCS soil survey or local assistance can help you determine the erosion potential of a soil.

#### **Waterbody Use**

There may be cases where a waterbody of special designation should have extra precautions taken to insure water quality is protected (see sidebar).

#### **Vegetation and Groundcover**

Vegetation and groundcover are the main reason that SMZs and riparian buffers work. Recognizing the amount and distribution of vegetation or groundcover can influence the extent of activities within the SMZ or buffer.

#### **Other Purposes**

Even though water quality is the focus of this manual, SMZs and riparian buffers can help you achieve many different goals at the same time. To achieve these goals, an SMZ or buffer may need different treatment or size layout than what would normally be expected for protecting water quality.

## FPG

In North Carolina, the term “streamside management zone” is a defined item within the FPGs.

### Watch Out!

*If a forestry operation is deemed in non-compliance with the FPGs or DWQ ‘buffer rules’, the operation may also be subject to other state or local rules.*

*The NCSU Extension Forestry Department maintains a Web site of known local ordinances that may impact forestry:  
[www.ces.ncsu.edu/nreos/forest/ordinance/index.html](http://www.ces.ncsu.edu/nreos/forest/ordinance/index.html)*

## Part 2 -- Rules Related to SMZs and Riparian Buffers

North Carolina has several different requirements on the need, location, size and amount of activity for SMZs and riparian buffers:

- **Forest Practices Guidelines Related to Water Quality (FPGs)**  
Streamside Management Zones (SMZs) are defined in FPG .0201. There may be other sections within the FPGs that also apply to SMZs. In Parts 3, 4 and 5 of this chapter, there are BMPs related to SMZs that you might find useful in meeting the FPG standards.
- **DWQ riverbasin and watershed ‘Riparian Buffer Rules’**  
These rules are enforced by the N.C. Division of Water Quality (DWQ) and limit certain forestry operations within the required buffer area.
- **North Carolina General Statute 77-13**  
Obstructing streams a misdemeanor
- **North Carolina General Statute 77-14**  
Obstructions in streams and drainage ditches

### *A Note on Beaver Ponds:*

**Streamside Management Zones (SMZs) as defined and required under FPG .0201 are not required around beaver ponds:**

- However, it is still required that you comply with all of the FPGs as well as the applicable N.C. General Statutes related to stream/ditch obstructions.
- The installation and use of SMZs is most often an economical and effective preventative measure in these situations.

**Take note that the DWQ river basin and watershed ‘Riparian Buffer Rules’ are required alongside the margins of beaver ponds:**

- Seek professional technical assistance, if needed, to assess the options you may have in these circumstances on a site-by-site basis.

**This page briefly highlights the state-implemented requirements for SMZs and riparian buffers for forestry operations in North Carolina at the time of this manual's revision.**

*There may be additional state-mandated rules after the time of this manual's printing, or local rules that could be required on your job site.*

<p><i>The types of streams and waterbodies noted here are defined in the FPGs.</i></p> <p><i>Even though a stream has been modified, it is still a stream and requires attention to see if or how FPGs and other rules apply to it.</i></p>	<table border="1"> <tr> <td><b>Name:</b></td><td>Streamside Management Zone (SMZ)</td></tr> <tr> <td><b>Location:</b></td><td>Entire state on any forestry-related, site-disturbing activity</td></tr> <tr> <td><b>Applicability:</b></td><td>Required as defined in FPG .0201</td></tr> <tr> <td><b>Size Width:</b></td><td>Shall be of sufficient width to confine within the SMZ any visible sediment resulting from accelerated erosion.</td></tr> <tr> <td><b>Where to Use:</b></td><td>Shall be established along the margins of Intermittent streams, Perennial streams, and Perennial waterbodies as defined in the FPGs.</td></tr> </table>	<b>Name:</b>	Streamside Management Zone (SMZ)	<b>Location:</b>	Entire state on any forestry-related, site-disturbing activity	<b>Applicability:</b>	Required as defined in FPG .0201	<b>Size Width:</b>	Shall be of sufficient width to confine within the SMZ any visible sediment resulting from accelerated erosion.	<b>Where to Use:</b>	Shall be established along the margins of Intermittent streams, Perennial streams, and Perennial waterbodies as defined in the FPGs.
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## Part 3 -- Recommended SMZ Widths

### Helpful Hints:

*It is recognized that SMZ widths vary according to the purpose for the SMZ and the site's conditions.*

*Professional judgment is needed to determine the right SMZ width that matches the site-specific conditions while meeting water quality (or other) goals.*

**The general BMP recommendation for SMZ width is 50 feet along each side of intermittent streams, perennial streams, and perennial waterbodies.**

**The SMZ width should continue and wrap around the head of the stream, where the ephemeral(s) transitions into the stream channel:**

- Refer to Figure 4A on the following page for illustration of this concept.
- The waterbodies noted above follow the definitions described in the FPGs.
- Each of the DWQ Riparian Buffer Rules also has a required buffer width. Refer to the rule specific for your job site, if a 'buffer rule' applies.

**SMZs wider than 50 feet may be needed on sites that exhibit one or more of these conditions:**

- Steep slopes adjacent to the stream.
- Long, continuous slope lengths leading toward a stream.
- Highly erodible soils.
- Soil areas with little or minimal groundcover near the waterbody.
- Areas of intensive soil disturbance nearby the SMZ.
- Special waters (ex: trout, water supply, nutrient sensitive, shellfish, etc.)

**SMZs narrower than 50 feet may be suitable on sites that exhibit one or more of these conditions:**

- Flat terrain within or adjacent to the stream.
- Short slope lengths that lead toward the stream.
- Stable or undisturbed soils.
- Soils with sufficient groundcover or vegetation to allow sheetflow and/or adequate water infiltration
- Stable streambank.

Table 4-1 below provides a range of options for SMZ widths that may be suitable for your site and operation.

**Table 4-1: Range of Options for SMZ Widths on Forestry Operations in North Carolina**

The range of options for SMZ widths is adapted and summarized from various publications and/or reports that are cited in Appendix 12.	Objective of SMZ	Range of Suggested Widths (feet)	Factors to Consider in Selecting SMZ Width
	Sediment Control	30 to 150	Slope, Soils, Groundcover, Sediment Load, Waterbody Use
	Nutrient Management	15 to 200	Hydrology, Vegetation, Soils, Nutrient Load
	Streambank Stabilization	25 to 55	Vegetation, Soils, Streamflow
	Wildlife and Aquatic Organisms	25 to 300	Specific to each Species

**Caption:**

*The SMZ should wrap around the beginning of the stream channel, for the same general width as the SMZ used along the edge(s) of the stream.*

**Diagram Legend:**

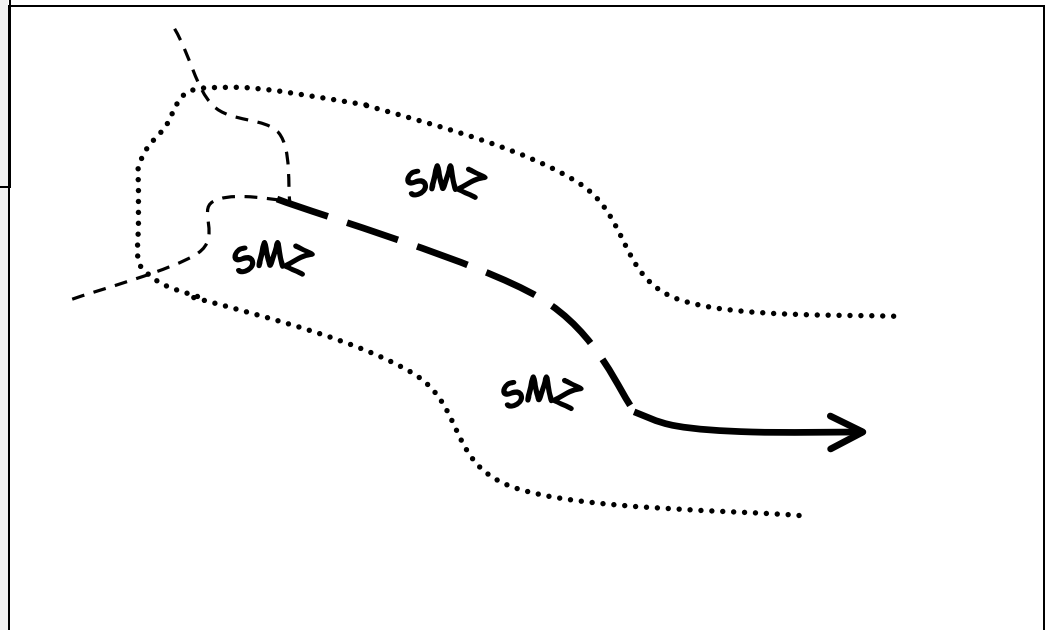
.....SMZ width.....

-----Ephemeral

-----Intermittent Stream

-----Perennial Stream→

**Figure 4A: Diagram showing SMZ continuing and wrapping around the head of a stream channel.**



**Caption:**

*SMZs are well maintained on this harvest operation.*

*The residual trees and vegetation within the SMZ should provide adequate shade and overall water quality protection.*

*Note the extent of skid trails on this harvest. Extensive erosion control work and/or stabilization will be needed to assure sedimentation is minimized from these skid trails.*

**Figure 4B: SMZ corridors on a timber harvest in Burke County, N.C.**



## Part 4 -- BMPs for Forest Operations in SMZs

### Timber Harvest

- Recognize waterbodies that are on the site before you start harvesting:
  - Pre-harvest planning can help you identify where SMZs are needed.
  - You may find it useful to mark the SMZ for easy identification and share this information with the heavy equipment operators.

**Watch Out!**

**Take note that each 'Riparian Buffer Rule' has different, specific requirements and limits on timber harvesting.**

- In those limited situations in which access roads, skid trails, decks, or portable mill sites must absolutely be placed within the SMZ:
  - Adhere to the requirements as specified under **FPG .0201**
  - Keep these features at least 10 feet away from the stream or waterbody
  - Limit heavy equipment usage within 10 feet of the edges of streams and waterbodies to protect bank stability and maintain the function of the riparian buffer.
- Maintain approximately half of the pre-harvest vegetative canopy cover within the SMZ in order to provide adequate shade:
  - If significant removal of overstory canopy trees occurs within the SMZ, minimize disturbance to the mid-level and understory vegetation in order to maintain shade-producing canopy cover.
- Allow no more than 20 percent evenly distributed bare soil surface within the SMZ.
- Fell and remove trees away from the stream or waterbody:
  - Do not use the SMZ as a 'de-limbing gate' for felled trees.
- When removing trees from the SMZ, avoid gouging the soil in a manner that could funnel runoff and transport sediment to the waterbody:
  - Promptly take action where needed to stabilize these disturbed spots and reduce the chance of accelerated erosion.
- Service and refuel equipment outside of the SMZ. If mechanical failure requires repair work, be sure to control any fluids and prevent them from entering the surface water or groundwater, as required in **FPG .0205**.

**Caption:**

*Take note of these BMPs:*

- *Shade is maintained in the SMZ, even with trees harvested.*
- *Soil disturbance is minimized*
- *Trees were not felled or de-limbed into the SMZ*
- *Streambank stability is maintained*

*Although this SMZ appears to be less than 50 feet due to the site's conditions, the careful attention to maintaining the SMZ should help protect water quality.*

**Figure 4C: Broadside view of SMZ in the central piedmont of North Carolina**





**Caption:**

*This SMZ is approximately 50-feet wide along each side of the stream.*

*The trees and vegetation left intact should provide adequate shade upon leaf-out in the spring.*

*It appears that heavy equipment usage was minimized within the SMZ, which reduces soil disturbance.*

**FPG**

**Caption:**

*Note the many BMPs:*

- Gentle sloping road grade and crowned surface
- Minimize road width through the SMZ
- Broad-based dip, with a sediment pit (center/left in photo)
- Seed and mulch applied on bare soil areas
- Silt fence along the stream channel (right photo edge)

**Figure 4D: SMZ on a timber harvest in Orange County, N.C.**



**Forest Roads**

- Keep roads out of the SMZ, as required in **FPG .0201**, unless barriers prevent them from being established outside of the SMZ.
- If roads must be placed within the SMZ:
  - Keep roads at least 10 feet away from the waterbody.
  - Establish only as wide of a road as needed to meet your safety and operation needs.
  - Minimize the amount of bare soil exposed.
  - Use suitable BMP tools to control runoff and capture sediment (see Chapter 5) or take other effective action to protect water quality.

**Figure 4E: A forest road constructed through a SMZ**



**Also Refer To...**

*Chapter 10 has additional BMPs for specific site-prep practices.*

## **Site Prep and Silviculture**

- Store forest chemicals such as pesticides or fertilizers outside of the SMZ.
- Conduct servicing, filling and fueling activities outside of the SMZ and as far from the stream or waterbody as practical. Refer to Chapter 8 for BMPs on fluids and Chapter 7 for BMPs on forest chemicals.
- Avoid high intensity prescribed burns within the SMZ that removes significant amounts of groundcover and/or organic matter. Chapter 9 has additional BMPs for fire management
- Minimize heavy equipment operation within the SMZ:
  - This will protect streambank stability and maintain SMZ function.
- Forest regeneration and timber stand improvement practices generally are acceptable in the SMZ, however:
  - Low-impact methods should be used to minimize use of heavy equipment and disturbance to soil and groundcover.
  - Additional BMPs or other suitable actions should be taken to protect water quality if significant removal of vegetation in the SMZ is needed for the regeneration of shade-intolerant tree species.

## **Part 5 -- BMPs for Special Cases**

**Watch Out!**

***These areas can present extremely challenging conditions for timber harvesting, and the risk/reward for conducting these activities should be seriously evaluated.***

*Braided stream areas often are also wetlands, and may require additional precautions.*

### **Braided Streams**

Braided streams have multiple, interconnected channels with very flat slope gradients, resembling the strands of a braid. Braided stream systems generally have broad valleys with well-defined floodplains. Such characteristics create unique conditions for timber harvesting and other forestry activities.

### **BMPs for Braided Streams**

- Locate and identify braided streams before starting operations. It is usually best to locate the channels during normal flow, because:
  - During dry times the braided channels may not appear to be significant enough to be considered as a stream
  - During flooded times, the entire floodplain may be underwater, and the individual braided channels will be hidden from view.
- Conduct operations during dry soil conditions whenever possible, and limit heavy equipment usage.
- Use matting systems for skid trails and/or road access, including the use of bridgemats for temporary channel crossings.
- Try to avoid heavy equipment usage when braided channels are close together, since access between each channel is extremely difficult to accomplish while still protecting water quality conditions.

**For Forest Owners:**

*Timber harvests in braided areas may take longer to complete, since site conditions may only allow a short time period for activities to take place.*



- When braided channels are wide apart, establish the appropriate SMZ and/or riparian buffer along the outermost channel limits and minimize soil disturbance between the channels.

### **Hydrologically-Connected Ditches**

**NOTE:** In this manual, a hydrologically-connected ditch refers to those ditches that have an immediate or eventual outlet to a stream.

While this Manual does not specifically recommend SMZs or buffers along ditches, action should be taken to prevent sediment and other nonpoint source pollution that may be produced by forestry operations from being transported by these features into streams or waterbodies.

### **BMPs for Hydrologically-Connected Ditches**

- Limit heavy equipment usage along the ditch edge to the extent that the structural integrity of the ditch bank is protected and sediment transport within the ditch is prevented.
- Establish temporary ditch crossings in a way that protects water quality from accelerated erosion or sedimentation while still allowing adequate water flow in the ditch.

#### **Helpful Hints:**

*Portable bridgemats or well-constructed pole crossings are usually appropriate for temporary ditch crossings, as well as culverts.*

#### **Caption:**

*This roadside ditch crossing uses steel bridgemats and wooden road pallets to effectively cross the ditch, while protecting the ditchbank integrity.*

*Extra logs are positioned to carry the overhang from the log trailer's wheels.*

**Figure 4F: Stabilized roadside ditch crossing in Bertie County, N.C.**



### Did You Know?

*On average, 80 to 85 percent of the land surface drains to the smallest of stream drainage ways within any given watershed. Ephemeral streams often are the first main drainageway that collects and funnels surface runoff from precipitation.*

## Ephemeral Streams

**NOTE:** In this Manual, an ephemeral stream refers to those as defined under the North Carolina FPGs, as cited in the glossary and Appendix 1.

While this manual does not specifically recommend SMZs or buffers along ephemeral drainages, action should be taken to prevent sediment and other nonpoint source pollution that may be produced by forestry operations from being transported by these features into streams or waterbodies.

### BMPs for Ephemeral Streams

- During forestry operations minimize disturbance to the soil and groundcover within the ephemeral stream area.
- When conducting site preparation, maintain surface groundcover and woody debris accumulations, if material already exists in place.
- If equipment must be operated in the ephemeral stream area, minimize the number, area and use of skid trails as well as access roads and decks.
- When establishing a SMZ on intermittent or perennial streams, the SMZ width should continue and wrap around the head of the stream, where the ephemeral(s) transitions into the stream channel.

**Figure 4G: Ephemeral area protected during logging**



### Caption:

*Note how the SMZ on this site was wrapped around the main channel where the ephemeral transitions into the stream.*

*Soil disturbance was minimized on the site, and within the SMZ.*

*It appears that no primary skid trails or decks were located within this ephemeral area, which is another BMP to consider.*